

Overview: This document shows an example of an introduction for the ECE 3300 labs. It can be used as a template for the Introduction in the Final Report.

For help: Contact the teacher assistants or class instructor. See website: <http://www.ece.utah.edu/~ece3300/>

1.0 INTRODUCTION

A microwave communication system was designed for an implantable medical device. Several such systems are currently in use around the world to improve the outpatient care of people suffering from heart failure and other related difficulties (Ross “Managing Care Through the Air”). *Give more information on why this is important.* *Insert problem statement (we need an antenna, why, what has been done so far)*

Dielectric properties of materials were measured and evaluated to determine a reasonable laboratory substitute for muscle tissue in order to provide a test bed for the system. The approximate loss and reflection of transmission lines used to connect the communication system to the antenna were evaluated. Simulations showed the expected fields inside the body and the field patterns generated by the antenna. Antennas were designed and prototyped in simulated muscle material, representing the characteristics for a torso-implanted device such as a cardiac pacemaker and defibrillator. The maximum depth and range of the implant were determined. Measurements were made on simulated physical tissue and transmission line systems to culminate in the understanding of a pacemaker communication system. The analysis performed gave insight into the design requirements for power, transmission frequency, materials, and antenna to be used in the system.

Following are detailed descriptions of each lab.

1.1 Dielectric Properties

In this lab, the electrical properties of the human body are evaluated in simulation and measurement. An artificial material made from water, salt, and sugar to replicate these properties is produced for 440 MHz based on a similar method to Hartsgrove, et al. tissue simulant materials for muscle, brain, and ... at ..., ..., and ... MHz. [4]. After measuring ϵ and σ of the material and converting them to $\epsilon = \epsilon' - j \times \epsilon''$, the propagation constant, wavelength, and attenuation were computed and analyzed. It is important to know the electrical properties of the human body in order to design an antenna that can be matched in the body, and also to determine how much power will be lost in the body for a given design. This impacts the communication range of the system and the safety of the patient.

1.2 Transmission Lines

1.3 Telegrapher's Equation Solution using Finite-Difference Time-Domain (FDTD)

- 1.4 Transient Analysis on Transmission Lines and the Time Domain Reflectometer (TDR)
- 1.5 Monopole Antenna Design and Impedance Matching
- 1.6 Numerical Integration for Biot-Savart's Law
- 1.7 Link Budget and Radiation Patterns
- 1.8 FSK Communication System

Conclusion

__% Salt water was used as a laboratory substitute for muscle tissue to provide a test bed for the system. The transmission lines were observed to have __ dB of loss between the antenna and the transmitter..... This was the major source of loss in the system.

Questions:

1. How long should weekly lab reports be? 0.75-1 page written plus figures (3-4 final pages)
2. How long should the final lab report be? As needed. (1/2 - 1 page intro plus 1/2 -1 page conclusion plus all labs)
3. Is this a good example introduction? good
4. The report template seems like it would be good for the weekly report if it were pared down a bit, and good for the final report with subsections on the introduction, methods, and results for each lab. done